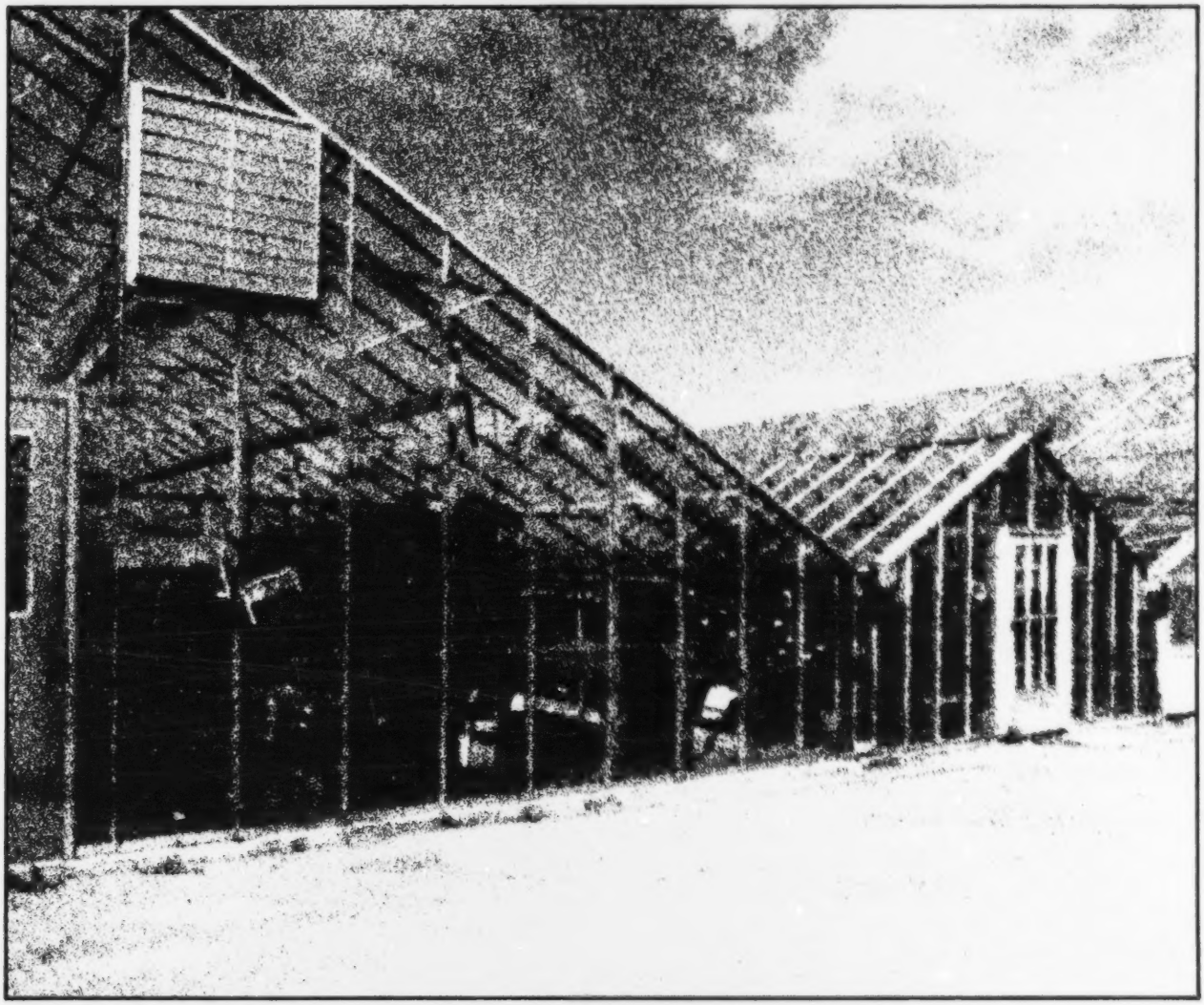
The Economics of Production and Marketing of Greenhouse Crops in Alberta

1988 - 89



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The Economics of Production and Marketing of Greenhouse Crops in Alberta 1988-89

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Foreword

Many Alberta greenhouse growers and individuals interested in the horticultural sector recognize that Alberta has the potential to greatly expand flower and vegetable production. Given such favorable conditions, questions have been asked as to why the provincial production of fresh produce has not significantly increased.

To answer these questions, Alberta greenhouse operators and the Alberta Protected Crops Advisory Committee requested, in the late seventies, that the Production Economics Branch of Alberta Agriculture undertake a comprehensive economic evaluation of the greenhouse industry. Since the first report in 1979, several reports documenting production costs and returns and factors affecting production of greenhouse crops have been published. These studies have been instrumental in the establishment of programs such as the Primary Producers' Energy Rebate Program, and helped gain greenhouse eligibility for loans from the Alberta Agricultural Development Corporation.

This greenhouse report examines the level of investment and production costs and returns for Alberta greenhouses by region, size, and crop, and updates the information contained in previous studies. It also reports on producer concerns related to the greenhouse industry in Alberta.

Dr. Carlyle Ross
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SECTION I

INTRODUCTION

The greenhouse industry in the province has gone through several adjustments, therefore the need was felt to develop costs and returns based on current conditions so that the industry can change accordingly. Because of changing economic conditions, previously compiled information on the greenhouse industry became more or less obsolete. The cost of natural gas and greenhouse supplies became major concerns in the late 1980's. This study updates the information compiled during the early 1980's, and evaluates the financial viability of the industry in the province.

Significant increases in natural gas cost for heating greenhouses and the price of greenhouse supplies created some economic difficulties for greenhouse operations in the province. Realizing these difficulties, the provincial government introduced an energy rebate program for primary agricultural producers whereby greenhouse operators can receive financial assistance to a maximum of $4,850 to supplement heating expenses.[1]

Surveys of the greenhouse industry were undertaken during 1978, 1979, 1982, 1983 1987 and 1988 to develop production costs and returns for major greenhouse crops and by size of greenhouse operations.

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[1]The Primary Producers' Energy Rebate program was introduced in October 1982. Under this program a greenhouse operator could receive a maximum assistance of $4,850 towards natural gas heating costs.

Reports based on each of the above surveys were published and have been used as guidelines for greenhouse investment decisions. The reports highlighted problems in production, marketing, transportation, availability of finance and other concerns of greenhouse operators in Alberta.

This report provides the most current information on greenhouse production costs and returns for the major greenhouse crops and by the size of greenhouse operations for the 1988-89 crop year.

Objectives of the Study

The major objectives of the study were:

1) Determination of the structure of the greenhouse industry in Alberta.
2) Estimation of greenhouse production costs and returns by major crops.
3) Identification of the main factors influencing production and marketing of greenhouse crops in Alberta.
4) Identification of major problems experienced by greenhouse producers in Alberta.

The Study Sample

A questionnaire was used to obtain the required information from a selected sample of greenhouse operators across the province. Twenty-two (22) greenhouse operators were interviewed to obtain production costs and returns information for the 1988-89 crop year.

Method of Analysis

The technique used to analyze the data was "SPSS" (Statistical Package for the Social Sciences). SPSS is an integrated system of computer programs for the analysis of social science data. It provides the user with a comprehensive set of procedures for data transformation and file manipulation, and offers the researcher a large number of statistical routines commonly used in the social sciences.[1]

After completion of the questionnaire, data were reviewed to make sure that no information was missing before entering it for analytical purposes.

Each greenhouse operation was analyzed separately. The study was divided into two geographical groups, three size groups, and crop groups of cucumbers, tomatoes, bedding plants and combination crops. The cucumber group was further subdivided into two groups. This breakdown provided representative cost and return estimates related to the type of crop produced and size of the greenhouse operation.

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[1] Norman, H. Nie; Dale H. Bent and C. Hadlai Hull, Statistical Package For The Social Sciences, McGraw-Hill Book Company, New York, April 1971, pp. 1-3.

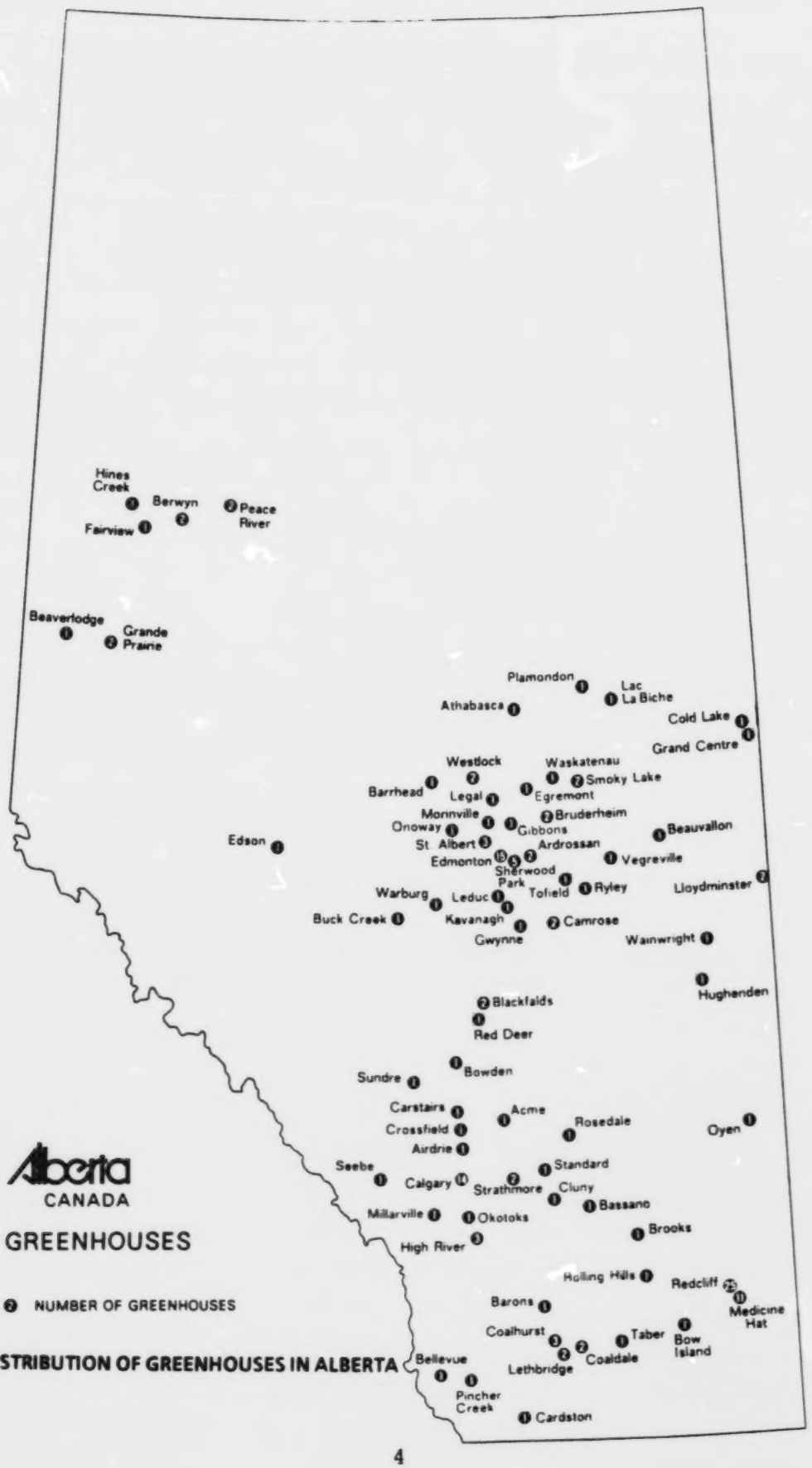

FIGURE 1: DISTRIBUTION OF GREENHOUSES IN ALBERTA

SECTION II

GREENHOUSE OPERATIONS IN ALBERTA

Although greenhouses in Alberta are scattered throughout the province, more than two-thirds of these operations are located in the south and south-central regions. The area around Medicine Hat is called "the greenhouse belt" of Alberta because of the Red Hat Co-op (a producer organization responsible for marketing cucumbers) and the large number of greenhouses in this area. Most greenhouse operations are located in cities and towns because of easy access to labour, marketing facilities, utilities and the services necessary for a greenhouse operation. Because of very high land prices and taxes, during the last several years a few new greenhouses have been built at a distance from major population centres. Distribution of greenhouses in Alberta is shown in Figure 1.

Survey of the Greenhouse Industry

According to a survey[1] of the greenhouse industry done in 1986, there were approximately 230 commercial greenhouse operations in Alberta with a total area of 6,043,040 square feet (561 398 square metres) or 138.9 acres (56.2 hectares).

This comprehensive survey, undertaken by the Alberta Tree Nursery and Horticulture Centre in Edmonton, provided detailed information on the structure of the greenhouse industry in the province. It reported on the types of crops grown in greenhouses, heating systems, types of greenhouse

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[1] Cathy Coyne and Mirza Mohyuddin, "Greenhouse Industry in Alberta", Alberta Tree Nursery and Horticulture Centre, Edmonton, October, 1986.

material, marketing of greenhouse produce, (wholesale and retail operations) and greenhouse operators' concerns, etc.

The three regions with the largest greenhouse area in the province are Medicine Hat (38 percent), Edmonton (21 percent), and Red Deer (12 percent). The remaining 29 percent of greenhouse area is scattered throughout the province, from Peace River in the north to Lethbridge in the south. Table 1 provides information on the size of the greenhouse industry in the province. Table 2 classifies greenhouse operations by area (size of greenhouse operation).

Table 3 lists the number of greenhouse operations surveyed in each city/town in 1986. The province was divided into these areas to obtain a better understanding of the location and size of greenhouse operations.

TABLE 1

DISTRIBUTION OF GREENHOUSE AREA BY MAJOR CENTERS

	Region	Area in Square Meters	Area in Square Feet	Percent Of Total
1.	Fort McMurray	1 894	20,382	0.43
2.	Grande Prairie	9 314	100,259	2.14
3.	Whitecourt	44 506	479,067	10.22
4.	Edmonton	90 189	970,794	20.70
5.	Bonnyville	5 051	54,364	1.16
6.	Lloydminster	3 455	37,186	0.79
7.	Red Deer	51 712	556,625	11.87
8.	Calgary	40 303	433,820	9.25
9.	Medicine Hat	165 680	1,783,380	38.03
10.	Lethbridge	23 541	253,397	5.40
	TOTAL	435 645	4,688,974	100.00

TABLE 2

DISTRIBUTION OF GREENHOUSE AREA BY SIZE OF OPERATION

Size of Operation (Sq Ft)	Number Surveyed	Percent of Total Surveyed
less than 10,000	84	39.81
10,000 to 19,999	56	26.54
20,000 to 50,000	54	25.59
more than 50,000	17	8.06
TOTAL	211	100.00

TABLE 3

NUMBER OF GREENHOUSES BY LOCATION

Area		Total Number Surveyed	Number in Regional Center
1.	Fort McMurray	4	2
2.	Grande Prairie	8	1
3.	Whitecourt	24	3
4.	Edmonton	44	21
5.	Bonnyville	7	2
6.	Lloydminster	5	1
7.	Red Deer	31	7
8.	Calgary	22	10
9.	Medicine Hat	41	35
10.	Lethbridge	25	9
	TOTAL	211	91

According to the survey done by the Alberta Tree Nursery and Horticulture Centre, 32 percent of the greenhouses have glass or glazing material as a covering, 41 percent have polyethylene, 24 percent have fiberglass, and the remaining three percent have polycarbonate.

Statistics Canada also conducts a survey of the greenhouse industry every year to identify the number of commercial operations in the province, crops grown, and the total output of crops produced in a controlled environment.

In 1988, although all greenhouse operations in Alberta were contacted by Statistics Canada, only 76 firms reported on their operations. The area reported by these firms was 3.569 million square feet, which is about half of the area reported in the 1986 census. In 1984, the number of firms reporting on their operations was 109. Greenhouse area reported by these firms was 2.755 million square feet. In 1985 the number of firms returning Statistics Canada

questionnaires decreased to 106 and the overall area reported by these firms also decreased to 2.573 million square feet. In 1986 the number of greenhouse firms reporting on their operations further declined to 59, however, the total greenhouse area reported by these firms increased to 2.683 million square feet. In 1987, the number of firms reporting on their operations increased to 67 and the total greenhouse area also increased to 3.162 million square feet. Table 4 provides greenhouse area by structure (glass and plastic) and sales of produce as reported by most of the commercial greenhouse operators in the province.

The Statistics Canada survey of the greenhouse industry reported average area per firm (Table 4), both under glass and plastic, at 25,276 square feet in 1984. It decreased to 24,274 square feet per firm in 1985. However, in 1986, average area per firm was 45,482 square feet, a substantial increase over 1985. This increase in average area per firm can be attributed to a greater number of large greenhouses reporting on their operations for this survey. In 1987, the number of firms reporting on their operations increased to 67 with an average area per firm being 41,201 square feet. The number of firms reporting their operations increased to 76 in 1988, with an average area of 46,960 square feet per firm.

Gross sales of greenhouse produce, as reported in the Statistics Canada survey (Table 4), amounted to $18.9 million in 1984, increasing to $22.6 million in 1985. Average sales per firm were $173,784 in 1984 and $213,578 in 1985. Total sales of greenhouse produce increased to $23.7 million in 1986 and rose to $27.6 million in 1987. In 1988, total sales of greenhouse produce (reported by 76 firms) was $30.5 million.

Average sales per firm increased to $402,513 in 1986 and $412,272 in 1987. Average sales per square foot were $6.88 in 1984, increasing to $8.85 in 1986. Average sales per firm per square foot were $8.73 in 1987 and finally $8.56 in 1988. Details regarding total area under glass and plastic, and total sales of vegetables, bedding plants, and ornamental flowers in Alberta for the years 1984 to 1988 are presented in Table 4.

The Statistics Canada survey does not provide a complete picture of the greenhouse industry in Alberta because a large number of growers failed to provide the required information. Greenhouse operators should make an effort to complete the short, one page questionnaire as it is to their advantage to know the size of their industry and the types of crops produced. If such information were available it would be helpful for planning crops which can be marketed easily in order to maximize profits.

Physical Characteristics of Greenhouses

Greenhouses in Alberta range from small sash roof "lean-to" houses constructed of a wood-frame sash, to large modern steel frame houses with truss supported roofs. Most new greenhouses are made of steel, wood or masonry, covered with either glass, fiberglass, double plastic, or a single layer of plastic. A survey by the Alberta greenhouse industry in 1986 reported over 6 million square feet (561 398 square metres) of greenhouse area in Alberta. The number of greenhouse operations surveyed was 230.

During the last eight or ten years "HYDROPONICS" has emerged in the Alberta greenhouse industry and is being used in the production of tomatoes, cucumbers, and lettuce.

TABLE 4

GREENHOUSE AREA AND SALES OF VEGETABLES
AND ORNAMENTAL FLOWERS IN ALBERTA

	1984	1985	1986	1987	1988
Number Reporting	109	106	59	67	76
Total Area Sq Ft	2,755,052	2,573,016	2,683,410	3,162,440	3,568,924
m^2	255 953	239 041	249 297	293 800	331 564
Average/Firm Sq Ft	25,276	24,274	45,482	47,201	46,960
m^2	2 348	2 255	4 225	4 385	4 363
Glass					
Number Reporting	47	42	29	42	49
Area Sq Ft	1,242,387	975,023	910,068	1,127,700	1,244,556
m^2	115 421	90 583	84 548	104 767	115 623
Average/Firm Sq Ft	26,434	23,215	31,382	26,850	25,399
Plastic					
Number Reporting	85	89	49	54	65
Area Sq Ft	1,512,665	1,597,993	1,773,342	2,034,746	2,324,368
m^2	140 531	148 548	164 749	189 033	215 941
Average/Firm Sq Ft	17,796	17,955	36,191	37,680	35,760
Sales					
Number Reporting	109	106	59	67	76
Total Sales($'000')	18.942	22.639	23.748	27.622	30.537
Average/Firm($)	173,784	213,578	402,513	412,272	401,806
Sales per Sq Ft($)	6.88	8.80	8.85	8.73	8.56
Sales per m^2	74.01	94.71	95.26	94.02	92.10

Source: Statistics Canada, GREENHOUSE INDUSTRY, Cat. No. 22 - 202, Annual, 1984-1988.

Although this greenhouse crop production technique has been in use for quite some time in the United States, eastern Canada, and British Columbia, it was not until 1978-1979 that it was introduced in Alberta. Now, over a dozen greenhouse operations in Alberta use the hydroponic methods of producing greenhouse crops, especially tomatoes. Several growers are evaluating the use of this technique for producing cucumbers, lettuce and other greenhouse crops.

The major internal features of greenhouse systems in Alberta are as follows:

Heating Systems

A year round greenhouse operation is heated, using natural gas, steam, propane, or coal, to maintain optimum temperatures for crops grown during the winter months. Some vegetable producing greenhouses operate 10 months of the year and close down during December and January. Almost all of the greenhouses in southern Alberta are heated by natural gas burners, and when combined with stove pipes these burners provide sufficient heating through natural air movement. Greenhouses in northern Alberta are equipped with natural gas boilers and hot water pipes for heating. All boiler heating systems have automatic temperature control devices.

In addition to heating systems, most greenhouses in Alberta are equipped with a pad and fan cooling system. The cooling system is essential if temperatures are to be lowered during the hot summer months.

Table 5 presents the various types of heating systems used in greenhouse operations in the province. In some cases a grower has more than one heating system.

Watering Systems

The watering of ground beds is usually done by the use of soaker hoses which run parallel to each side of the bed. Bench beds and potted plants are usually watered with the use of chapin tubes. Other operations may use water supply pipes along with garden hoses.

Supplementary Lighting

Very few greenhouses have supplementary lighting. Those that do, make use of ordinary lamps, usually five to six feet apart. Supplementary lighting is mostly used for producing chrysanthemums.

TABLE 5

GREENHOUSE HEATING SYSTEMS IN ALBERTA

	System	Number of Growers		System	Number of Growers
1.	Gas Furnace	121	8.	Infrared	2
2.	Steam	65	9.	Oil Furnace	2
3.	Hot Water	29	10.	Electric	2
4.	Coal	8	11.	Waste Heat	2
5.	Propane	6	12.	Kerosene	1
6.	Wood	6	13.	Bio-Therm (Hot Water)	1
7.	Stove Pipe Heater	5			

Greenhouse Crops

Greenhouses in Alberta produce many kinds of flowers; chrysanthemums, roses, and geraniums being the most common potted plants. Outdoor flowers such as petunias and marigolds are also produced in these greenhouses. Some greenhouse operations concentrate on importing tropical plants which are acclimatized to Alberta conditions before

resale. The most commonly grown greenhouse vegetables are cucumbers, tomatoes, and lettuce. During the last few years attempts have been made to grow peppers, eggplants, cauliflower, cabbage and Chinese vegetables, as well as other crops.

Table 6 lists the types of crops grown in greenhouses across the province. The only greenhouses growing a single crop are ones producing vegetables, and a few of these also grow bedding plants. Most greenhouses produce a number of crops.

Greenhouses surveyed for the 1988-89 crop year were divided into two groups on the basis of the major crops grown. Thirteen greenhouses produced Long English cucumbers only. Six greenhouses produced bedding plants, potted and cut mums, poinsettias, foliage plants, roses, cucumbers, and tomatoes. Two greenhouse operations produced bedding plants and one greenhouse produced tomatoes only. Greenhouses producing a variety of crops were in operation year round, whereas the vegetable greenhouses were in operation for about 10 months, February through November. Those producing bedding plants were in operation for about five months, February to June.

Greenhouse Production

The only data available indicating the value of greenhouse production in Alberta are the gross sales compiled by Statistics Canada through a survey of the industry. These sales amounted to $18.9 million in 1984, $22.6 million in 1985, $23.7 million in 1986, $27.6 million in 1987 and $30.5 million in 1988 (Table 4). The number of firms reporting on gross sales decreased to 59 in 1986, from 106 in 1985. Even with a decrease in the number of firms reporting in 1986, gross sales increased. This could be

attributed to a higher percentage of large greenhouse operators responding to the questionnaire because they realize it is to their advantage to know the size of, and trends in, the Alberta greenhouse industry. Gross sales of greenhouse products in Alberta are estimated to be about $40 million. During the last few years, some greenhouse operations have diversified and are producing more than one crop at the same time.

Marketing of Greenhouse Produce

Greenhouse operators surveyed for the 1988-89 crop year used several channels to market their produce. The most important of these were retail facilities owned by greenhouse operators, either attached to the greenhouses or located in an urban area; other retail and wholesale facilities; the Co-op at Redcliff; and farmers' markets in various centers. The Red Hat Co-op at Redcliff serves as the focal point for the marketing of Long English cucumbers grown in and around Medicine Hat and Redcliff. Cucumber producers in north-central Alberta market their produce through the Sunfresh Co-op in Edmonton. Greenhouse operators pay a commission, or fee, set by the Board of Directors of the Co-ops to cover grading, packaging, storage, marketing and administration costs.

In north-central Alberta, greenhouses producing vegetables and bedding plants sold a large percentage of their produce at the gate and through rented stalls and booths in shopping centres and at farmers' markets. Farmers' markets have become popular marketing outlets, especially during the bedding plant season.

TABLE 6

TYPES OF GREENHOUSE CROPS
GROWN IN ALBERTA, 1986

	Area	Cucumbers	Tomatoes	Other Veg*	Bedding Plants	Ornamentals Cuts & Pots	Foliage
1.	Ft. McMurray	2	2	1	1	0	0
2.	Grande Prairie	1	2	1	7	2	3
3.	Whitecourt	3	11	1	16	7	7
4.	Edmonton	13	17	4	42	27	24
5.	Bonnyville	1	1	0	4	2	3
6.	Lloydminster	0	0	0	4	3	2
7.	Red Deer	7	10	3	26	10	13
8.	Calgary	4	5	3	18	14	13
9.	Medicine Hat	35	5	1	7	9	2
10.	Lethbridge	3	8	1	12	5	2
	TOTAL	69	61	15	136	79	69

*Other vegetables include: peppers, eggplants, lettuce, cauliflower, cabbage, and Chinese vegetables.

SECTION III

GREENHOUSE PRODUCTION COSTS AND RETURNS

Computation of Individual Cost Components

Interest on Investment:

Interest is defined as a sum paid or calculated for the use of capital. The sum is usually expressed in terms of a rate or percentage of the capital involved, called the interest rate.

Interest is charged for the use of investment capital. Had the capital not been invested to buy a specific asset, it could have been used elsewhere, either within or outside the firm, and would have brought some additional return to the firm.

A flat rate of 10 percent was used for the purposes of this study to determine a fair return to land, building and equipment investment. Interest on operating capital was the actual rate of interest paid by the study participants.

Depreciation:

Depreciation is defined as the loss in value of an asset over time, mainly as a result of obsolescence. In the case of buildings and equipment, it is that portion of the decrease in value resulting from the passage of time. Obviously, part of the reduced value of the buildings and equipment is the result of usage and is considered a variable cost. The entire depreciation is considered a fixed cost.

In computing depreciation, a 10 percent allowance or salvage value is taken from the purchase price of the buildings and equipment. The following formula was used in arriving at depreciation for buildings and equipment.

$$\text{Depreciation} = \frac{\text{Purchase Price - Salvage Value}}{\text{Number of Years of Life}}$$

Land Value:

Land associated with each greenhouse operation was valued at $1,700 per acre, irrespective of its location. This value was determined through real estate values for good farmland suitable for a greenhouse operation. It can be argued that allocation of such a value distorts cost of land in and around urban areas relative to farmland. However, for uniformity and reasonable cost estimates, it was decided to standardize the land value regardless of its location. Researchers are aware that land values in cities or towns are much higher than $1,700 per acre, but if market values were used for land acquired ten years ago, it would lead to artificially high fixed costs that would greatly inflate overall production costs. Most of the greenhouse operators surveyed have been in business for quite some time, with the exception of a few who got started within the last eight years or so.

Property and Business Taxes:

Taxes on real estate include payments made on the assessed value of the greenhouse operation less any assessment for the greenhouse operator's residence or operations other than the greenhouse. There is a business tax on greenhouses located in urban municipalities. Exact amounts of property and business taxes were included in the costs.

Labour Costs:

Hired labour costs included the amount of wages and any benefits received by the hired workers, such as contributions to Workers' Compensation, Canada Pension Plan, and Unemployment Insurance.

The hours spent by the operator and his/her family in greenhouse production were estimated. An operator's labour was valued at $7.50 per hour, and family labour was valued at either the rate paid to hired labour or the actual amount paid to family members.

Production Materials and Supplies:

Production materials and supplies included the purchase of cuttings, seed plants, fertilizers, chemicals, soils, vermiculite, perlite, peat moss, straw, peat pots, and plastic. Costs of production materials and supplies were the actual figures provided by the study participants.

Heating Costs:

Almost all greenhouse operators had reasonably accurate costs for heating the greenhouses with natural gas. Monthly bills were helpful in arriving at the total heating costs.

Utility Costs:

Utility costs included electricity, telephone, and water. Where the utility bill was combined with the greenhouse operator's residence, the operator was asked to apportion the bill to arrive at total utility costs for the greenhouse operation.

Transportation Expenses:

Expenses for trucks or other vehicles owned by greenhouse operators were apportioned according to their use in the greenhouse operation, and personal and leisure driving. Freight charges paid to commercial or private carriers for hauling greenhouse produce or supplies were included in the transportation expenses.

Maintenance Costs:

Maintenance costs included repairs to greenhouse structures, boilers, heating equipment, tractors, and all other machinery and equipment associated with the greenhouse operation.

Miscellaneous Costs:

These costs include legal and accounting fees, office supplies, bad debts, donations, membership fees, insurance costs, and other costs incurred in a greenhouse operation but not reported under any other heading.

Marketing Charges:

Marketing charges were the actual amount paid by each greenhouse operator for having produce marketed through the Redcliff and Edmonton Co-ops. These charges covered grading, packaging, marketing, and administrative fees. The charges paid by each grower were included as a cost item in the study.

Greenhouse Investment Costs by Regions

Greenhouse investment costs for the 1988-89 crop year were obtained directly from study participants during the

survey. Each operator was asked to value the greenhouse structure based on the current market costs of replacement. Study participants were also asked to provide an estimate of the life of the structure in order to calculate interest and depreciation costs. Figure 2 shows Alberta Agricultural regions. Greenhouses located north of Red Deer were included in Group I and south of Red Deer were included in Group II.

Investment costs were calculated on land, buildings, machinery, automotives and other miscellaneous equipment. The rate of interest used for determining interest costs for land, buildings, and equipment was 10 percent. Details on average investment and investment costs for the greenhouses in Group I, Group II, and the study sample are presented in Table 7.

Land Investment

The average land area associated with the greenhouses, such as building (production area and office) and parking space, was 6.07 acres for Group I participants, 2.14 acres for Group II participants, and 3.93 acres for the study sample. Average land investments per greenhouse in Group I, Group II, and the study sample were $10,32, $3,644, and $6,679, respectively. Land investment costs (land interest) for each greenhouse averaged $0.02, $0.01, and $0.02, per square foot for Group I, Group II, and the study sample, respectively.

Building Investment

The average building investment based on the market value of the greenhouse facilities studied during 1988-89 was $372,470 per greenhouse in Group I, $181,508 per greenhouse in Group II, and $268,309 per greenhouse for the

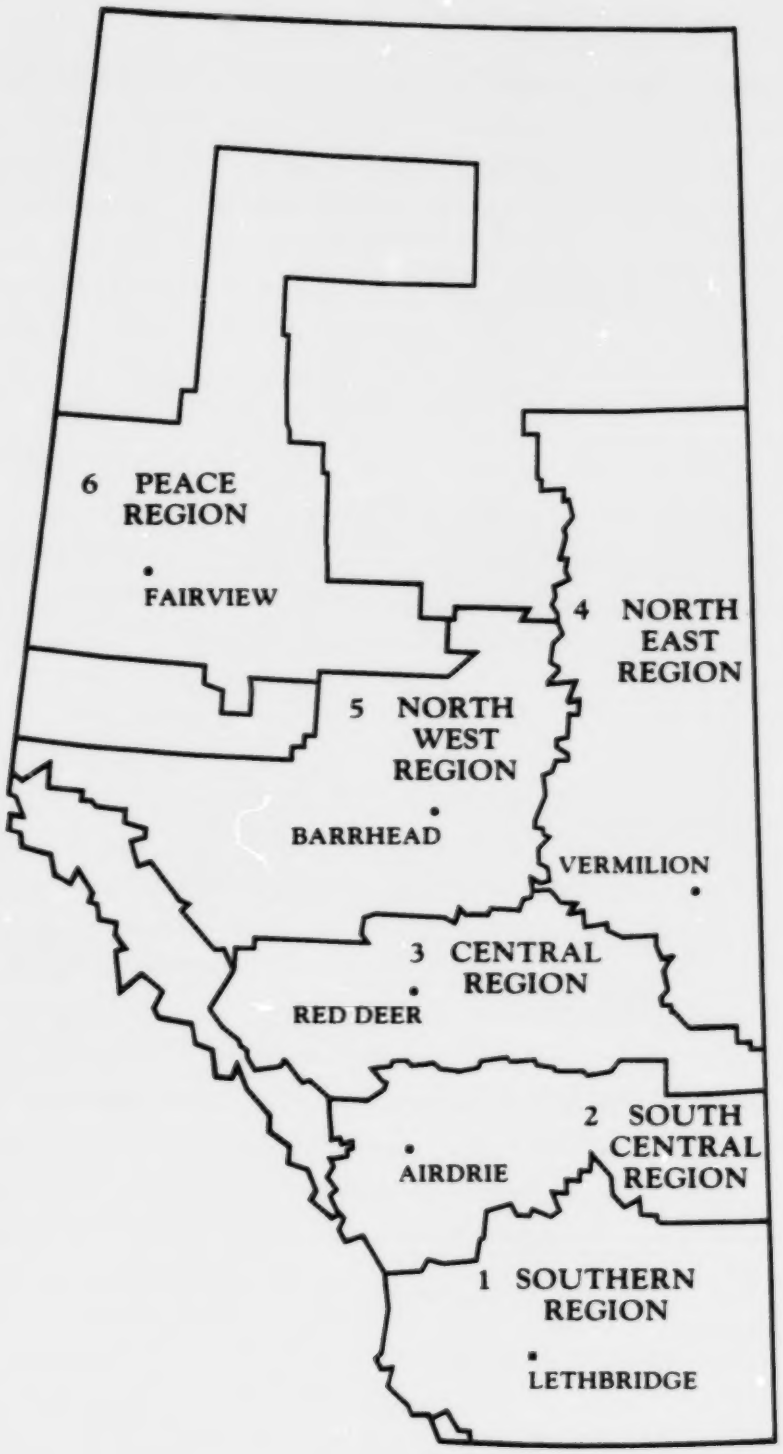


FIGURE 2: ALBERTA AGRICULTURAL REGIONS

TABLE 7

AVERAGE INVESTMENT AND INVESTMENT COSTS FOR THE GREENHOUSES SURVEYED, 1988-89

	Group I	Group II	Study Sample
Number Surveyed	10	12	22
Land Area (acres)	6.07	2.14	3.93
Land Value ($)	10,320.70	3,643.67	6,678.68
Land Interest ($)	1,032.07	364.67	667.87
Land Interest ($/sq ft)	0.02	0.01	0.02
Building Area (sq ft)	48,062	41,023	44,223
Building Investment ($)	372,470.56	181,508.31	268,309.31
Building Interest ($)	37,247.04	18,150.83	26,830.93
Building Depreciation ($)	7,113.35	2,027.39	4,339.18
Avg Building Interest & Deprec ($/sq ft)	0.92	0.49	0.70
Equipment Investment ($)	77,130.56	105,973.00	92,862.81
Equipment Interest ($)	7,713.05	10,597.30	9,286.28
Equipment Depreciation ($)	2,697.69	2,500.82	2,590.30
Avg Equip Interest & Deprec ($/sq ft)	0.22	0.32	0.27
Automotive Investment ($)	9,172.90	16,461.41	13,148.45
Automotive Interest ($)	917.29	1,646.14	1,314.85
Automotive Depreciation ($)	397.82	587.82	501.45
Avg Auto Interest & Deprec ($/sq ft)	0.03	0.05	0.04
Average Investment ($)	469,094.75	307,586.25	380,449.19
Average Investment ($/sq ft)	9.76	7.50	8.62
Average Investment Costs ($)	57,118.29	35,874.63	45,530.84
Average Investment Costs ($/sq ft)	1.19	0.87	1.03

Group I represents north and north-central regions (3,4,5 and 6)
Group II represents south and south-central regions (1 and 2)

study sample. Average investment costs (interest and depreciation) on buildings were $44,360, $20,178, and $31,170 per greenhouse for Group I, Group II, and the study sample respectively. The corresponding investment costs per square foot of greenhouse were $0.92, $0.49, and $0.70, respectively.

Equipment Investment

Average equipment investment based on the purchase price was $77,131 per greenhouse for Group I, $105,973 for Group II, and $92,863 for the study sample. Average investment costs for machinery and equipment were $0.22, $0.32, and $0.27 per square foot for Group I, Group II, and the study sample, respectively. Details on investment and investment costs i.e., interest and depreciation on machinery and equipment are presented in Table 7.

Automotive Investment

Average investment in automobiles was $9,173 per greenhouse for participants in Group I, $16,461 for Group II, and $13,148 for the study sample. Average investment costs for automotives amounted to $0.04 per square foot for the study sample.

Total Investment and Investment Costs

Average investment per greenhouse for participants in north and north-central Alberta (Group I) was $469,095, compared to $307,586 per greenhouse for the participants in south and south-central Alberta (Group II). Average investment for the study sample was $380,999 per greenhouse. Average investment per square foot of greenhouse area was $9.76, $7.50, and $8.62, for Group I, Group II, and the

study sample, respectively. Details on average investment and investment costs are provided in Table 7.

Average investment costs per greenhouse were $57,118 for Group I, $35,875 for Group II, and $45,531 for the study sample. Average investment costs per square foot ranged from $0.87 for Group II to $1.19 for greenhouse operators in Group I and $1.03 for the study sample.

Greenhouse Operating Costs by Regions

Greenhouse operating costs include all costs incurred during the production of greenhouse crops. Some of the most common operating costs are hired labour, material inputs (seed, chemicals, and fertilizers), containers, greenhouse fuel, repairs, maintenance, power, water, property taxes and purchase of supplies. Average operating costs incurred in greenhouses, by region, during the 1988-89 crop year are provided in Table 8. The highest operating cost item was material inputs at $112,985 for Group I, followed by hired labour at $99,472 per greenhouse. Hired labour was the highest operating cost item for greenhouse operators in Group II at at $55,323 followed by greenhouse heating costs at $25,820 and material inputs at $23,899. Fuel costs for heating greenhouses were $31,827 for Group I, and $28,550 for the study sample.

Greenhouses in north and north-central Alberta (Group I) reported average operating costs of $327,579 per greenhouse versus $165,075 in south and south-central Alberta (Group II). Average operating costs for the study sample amounted to $238,940 (Table 8). Average operating costs per square foot of greenhouse area for Group I, Group II, and the study sample were $6.82, $4.02, and $5.40, respectively.

Greenhouse Production Costs and Returns by Regions

The results presented in Table 8 show that the major costs in greenhouse operations were labour (hired, operator, and family), followed by material inputs, greenhouse fuel, and repairs and maintenance.

Production costs related to the above for the study sample were 33 percent and 20 percent, 9 percent, and 5 percent, respectively. Average fuel and utility costs per greenhouse operation were about 15 percent of total operating costs for both greenhouse groups.

Production costs for the typical greenhouse surveyed for the 1988-89 crop year amounted to $315,207 or $7.13 per square foot. For greenhouses in north and north-central Alberta (Group I), the costs were $417,434 compared with $230,018 for greenhouses in south and south-central Alberta (Group II). The corresponding average production costs per square foot were $8.69 and $5.61, respectively.

The average gross revenue per greenhouse in 1988-89 for the study sample was $323,065, or $7.31 per square foot. For Group I, average gross revenue was $438,335, or $9.12 per square foot, versus $227,007 or $5.53 per square foot for Group II.

The average return over operating costs was positive for both groups of growers and the study sample, at $2.30 for Group I, $1.51 for Group II, and $1.90 for the study sample.

The average return to management was positive for Group I growers at $0.43 per square foot. Return to management was negative at $0.07 per square foot for Group II

TABLE 8

COMPARISON OF COSTS AND RETURNS BETWEEN NORTH-CENTRAL AND SOUTH-CENTRAL REGIONS AND THE STUDY SAMPLE

	North Central	South Central	Study Sample
Number Surveyed	10	12	22
Greenhouse Area (sq ft)	48,062	41,023	44,223
	- - - - - - - dollars - - - - - - -		
GROSS REVENUE	438,334.75	227,007.06	323,065.12
GROSS REVENUE PER SQ FT	9.12	5.53	7.31
Material Inputs	112,984.65	23,899.50	54,392.73
Hired Labour	99,471.56	51,323.50	73,209.00
Greenhouse Fuel	31,827.50	25,819.66	28,550.50
Utilities	10,810.10	4,925.08	7,600.09
Insurance and Registration Fees	4,589.00	2,740.00	3,580.45
Repairs and Maintenance	15,339.60	16,600.08	16,027.13
Freight Leasing and Express	7,708.70	1,194.58	4,155.54
Taxes	1,584.70	3,739.33	2,759.66
Advertising	14,067.40	1,650.00	7,294.27
Accounting and Legal	2,586.30	1,302.50	1,886.05
Marketing Costs	10,153.20	16,242.91	13,474.86
Miscellaneous	6,573.30	6,896.66	6,749.68
Interest on Operating Capital	9,883.10	8,741.16	9,260.23
TOTAL OPERATING COSTS	327,579.11	165,075.00	238,940.50
Land, Buildings & Equipment Interest	46,909.45	30,758.63	38,099.91
Depreciation	10,208.62	5,115.98	7,430.81
Operator Labour	32,736.60	29,069.08	30,736.13
TOTAL OTHER COSTS	89,854.67	64,943.69	76,266.81
TOTAL PRODUCTION COSTS	417,433.78	230,018.37	315,206.87
TOTAL PRODUCTION COSTS PER SQ FT	8.69	5.61	7.13
Return Over Operating Costs	110,755.64	61,932.08	84,124.62
Return Over Operating Costs per sq ft	2.30	1.51	1.90
Return to Management	20,901.09	(3,011.56)	7,857.85
Return to Management per sq ft	0.43	(0.07)	0.18

Includes small tools, shop supplies, soil testing, office supplies, donations, memberships, travel and promotional costs other than advertising.

participants. It was positive for the study sample at $0.18 per square foot. Details on costs and returns by region and the study sample are presented in Table 8.

Investment Costs for Greenhouses Producing Cucumbers

The study sample was divided into two main categories according to the type of crop produced. There were 13 greenhouse operations producing mainly cucumbers and the remaining nine operations produced bedding plants, floricultural crops, cucumbers and tomatoes with bedding plants and other floricultural crops being the major enterprises.

Cucumber producing greenhouses were further divided into two groups by region. Eleven greenhouse operations were in south and south-central Alberta and five in north and north-central Alberta.

Average land area associated with the cucumber producing greenhouses in north-central Alberta was 2.27 acres compared to 1.22 acres for south-central Alberta. However, average greenhouse area for cucumber growers in south central Alberta was 28,438 square feet, versus 14,550 square feet for north-central growers.

Average building, equipment, and automotive investment was $137,487 per greenhouse for cucumber growers in north-central Alberta, compared to $183,902 for growers in south-central Alberta. The average investment per square foot for both groups was $10.00 and $6.47, respectively. Details on average investment and investment costs for cucumber producing greenhouses are given in Table 9.

TABLE 9

AVERAGE INVESTMENT AND INVESTMENT COSTS FOR GREENHOUSES PRODUCING CUCUMBERS AND TOMATOES

	Cucumbers North Central	Cucumbers South Central	Tomatoes
Number Surveyed	5	11	6
Land Area (acres)	2.27	1.22	0.76
Land Value ($)	3,862.40	2,078.63	1,289.17
Land Interest ($)	386.24	207.86	128.92
Land Interest ($/sq ft)	0.03	0.01	0.01
Building Area (sq ft)	14,550	28,438	8,888
Building Investment ($)	67,801.37	126,647.25	44,880.66
Building Interest ($)	6,780.14	12,664.72	4,488.07
Building Depreciation ($)	1,440.26	1,437.66	789.90
Avg Building Interest & Deprec ($/sq ft)	0.56	0.50	0.59
Equipment Investment ($)	60,210.19	47,590.00	14,385.83
Equipment Interest ($)	6,021.02	4,759.00	1,438.58
Equipment Depreciation ($)	2,350.92	1,229.93	569.16
Avg Equip Interest & Deprec ($/sq ft)	0.58	0.21	0.23
Automotive Investment ($)	5,613.40	7,587.18	2,380.00
Automotive Interest ($)	561.34	758.72	238.00
Automotive Depreciation ($)	262.99	290.70	111.21
Avg Auto Interest & Deprec ($/sq ft)	0.06	0.04	0.04
Average Investment ($)	137,486.97	183,209.87	62,935.64
Average Investment ($/sq ft)	9.45	6.47	7.08
Average Investment Costs ($)	17,802.89	21,348.59	7,763.83
Average Investment Costs ($/sq ft)	1.23	0.75	0.87

Operating Costs for Greenhouses Producing Cucumbers

As mentioned above, greenhouses producing cucumbers were divided into two groups. A comparison of operating costs for both groups is presented in Table 10. Marketing was the largest cost item for both groups of greenhouse followed by interest on operating capital for north-central cucumber producing greenhouses and greenhouse fuel for south-central greenhouses. Hired labour was the third largest cost item for both groups.

Average operating costs per greenhouse were $78,046 or $5.37 per square foot for north-central greenhouses compared to $2.56 per square foot for cucumber producing greenhouses in south-central Alberta. Details on individual operating cost items are given in Table 10. North-central Alberta cucumber growers incurred more than double the operating costs of cucumber growers in south-central Alberta.

Production Costs and Returns For Greenhouses Producing Cucumbers

The average gross revenue for greenhouse operators producing cucumbers was $111,523 ($7.66 per square foot) and $117,392 ($4.13 per square foot) for north-central and south-central groups, respectively. The cucumber producing greenhouse operations in north-central reported considerably higher yields per plant than their counterparts in south-central Alberta.

Average production costs for north-central cucumber producers in soil were $111,962 per greenhouse, or $7.70 per square foot of the greenhouse area. For the south-central cucumber producers, average production costs per greenhouse in 1988 amounted to $120,417 or $4.23 per square foot.

TABLE 10

COSTS AND RETURNS FOR GREENHOUSES
PRODUCING CUCUMBERS AND TOMATOES

	Cucumbers North Central	Cucumbers South Central	Tomatoes
Number Surveyed	5	11	6
Greenhouse Area (sq ft)	14,550	28,438	8,888
	- - - - - - - dollars - - - - - -		
GROSS REVENUE	111,523.56	117,392.44	35,350.83
GROSS REVENUE PER SQ FT	7.66	4.13	3.98
Material Inputs	10,973.40	7,795.63	5,301.33
Hired Labour	10,267.00	9,347.82	6,552.66
Greenhouse Fuel	8,939.00	14,507.36	5,490.66
Utilities	4,931.00	2,756.45	2,024.50
Insurance and Registration Fees	1,912.00	2,302.73	788.67
Repairs and Maintenance	4,151.00	7,199.36	2,226.17
Freight Leasing and Express	1,626.00	168.18	115.50
Taxes	16.80	2,895.23	171.09
Advertising	682.40	177.73	987.83
Accounting and Legal	269.40	929.55	248.00
Marketing Costs	18,860.00	17,097.28	1,219.00
Miscellaneous[1]	1,916.76	1,777.24	450.84
Interest on Operating Capital	13,500.80	5,834.00	1,823.67
TOTAL OPERATING COSTS	78,045.56	72,788.56	27,399.91
Land, Buildings & Equipment Interest	13,748.72	18,390.29	6,293.56
Depreciation	4,053.73	2,958.30	1,469.97
Operator Labour	16,113.80	26,280.36	8,453.83
TOTAL OTHER COSTS	33,916.25	47,628.95	16,217.36
TOTAL PRODUCTION COSTS	111,961.81	120,417.44	43,617.25
TOTAL PRODUCTION COSTS PER SQ FT	7.70	4.23	4.91
Return Over Operating Costs	31,478.00	44,603.86	7,950.91
Return Over Operating Costs per sq ft	2.29	1.57	0.89
Return to Management	(3,238.25)	(3,025.07)	(8,266.44)
Return to Management per sq ft	(0.04)	(0.11)	(0.93)

1 Includes small tools, shop supplies, soil testing, office supplies, memberships, travel and promotional costs other than advertising.

Average return over operating costs was relatively higher for greenhouses producing cucumbers in north-central Alberta compared with greenhouses in south-central Alberta. Average return over operating cost was $2.29 per square foot for greenhouses in north-central Alberta, vs. $1.57 per square foot for cucumber producers in south-central Alberta. However, return to management was negative for both the groups at $0.04 and $0.11 per square foot for north-central and south-central cucumber producers, respectively.

The major costs for greenhouses producing cucumbers resulted from marketing, greenhouse fuel, hired labour, and interest paid on operating capital. Table 10 provides a breakdown of investment, operating, and other costs.

Investment Costs for Greenhouses Producing Tomatoes

Six greenhouse operations from the study sample produced tomatoes along with other crops with the exception of one operation. Average land area associated with tomato producing greenhouses was 0.76 acre. Average greenhouse area for the six producers was 8,888 square feet per greenhouse.

Average building, equipment, and automotive investment amounted to $62,936 per greenhouse operation or $7.08 per square foot for the tomato producing group. Average investment costs for buildings, equipment, and automotives were estimated at $7,764 or $0.87 per square. Details on average investment and investment costs for producing greenhouse tomatoes are presented in Table 9.

Operating Costs for Greenhouses Producing Tomatoes

Hired labour was the highest operating cost item for the greenhouses producing tomatoes. It was followed by

greenhouse fuel, containers, labels and tags, and repairs and maintenance. Average total operating costs for this group amounted to $27,400 per greenhouse at $3.08 per square foot. Details on operating costs for greenhouse tomatoes are given in Table 10.

Production Costs and Returns for Greenhouses Producing Tomatoes

The average gross revenue for greenhouse operations producing tomatoes was $35,351 per operation in 1988. Gross revenue per square foot of the greenhouse area was $3.98.

Average production costs for the tomato producing group was $43,617 per operation, or $4.91 per square foot. Average return over operating costs per square foot was $0.89 per square foot. Average return to management was negative at $0.93 per square foot. The users of the information are cautioned that a few of the growers producing tomatoes did not attain the expected yield levels because of minor production problems.

Greenhouse Investment Costs for Bedding Plants and Combination Crops

The study sample was further divided into two categories, i.e., bedding plants and combination crops (mums, foliage plants, alstermeria, poinsettias, bedding plants and roses). Greenhouses producing vegetables only were not included in the combination crops group. There were eight (8) greenhouse operations which produced bedding plants along with other crops. Two (2) greenhouse operations produced bedding plants only. A few of the greenhouse operations produced more than four crops, thus reflecting a higher number under combination crops.

TABLE 11

AVERAGE INVESTMENT AND INVESTMENT COSTS FOR
GREENHOUSES PRODUCING BEDDING PLANTS AND COMBINATION CROPS

	BEDDING PLANTS	COMBINATION CROPS
Number Surveyed	8	17
Land Area (acres)	4.21	3.32
Land Value ($)	7,154.87	5,637.00
Land Interest ($)	715.49	563.70
Land Interest ($/sq ft)	0.02	0.02
Building Area (sq ft)	35,023	32,768
Building Investment ($)	256,589.00	218,125.37
Building Interest ($)	25,658.89	21,812.53
Building Depreciation ($)	4,521.95	3,790.23
Avg Building Interest & Deprec ($/sq ft)	0.86	0.78
Equipment Investment ($)	26,110.37	56,004.76
Equipment Interest ($)	2,611.04	5,600.46
Equipment Depreciation ($)	954.38	1,372.62
Avg Equip Interest & Deprec ($/sq ft)	0.10	0.21
Automotive Investment ($)	4,987.00	9,267.59
Automotive Interest ($)	498.70	926.76
Automotive Depreciation ($)	231.58	341.97
Avg Auto Interest & Deprec ($/sq ft)	0.02	0.04
Average Investment ($)	294,841.12	289,034.62
Average Investment ($/sq ft)	8.42	8.82
Average Investment Costs ($)	35,192.01	34,408.26
Average Investment Costs ($/sq ft)	1.00	1.05

Average land area associated with the group of greenhouses producing bedding plants was 4.21 acres. It was 3.32 acres for greenhouses producing combination crops. Average greenhouse area for bedding plants was 35,023 square feet compared to 32,768 square feet for the combination crops group.

Average building, equipment and automotive investment amounted to $294,841 per greenhouse or $8.42 per square foot for the bedding plants group. It was $289,035 per greenhouse or $8.82 per square foot for the combination crops group. Details on investment and investment costs for greenhouses producing bedding plants and combination crops are given in Table 11.

Greenhouse Operating Costs for Bedding Plants and Combination Crops

Material inputs (growing media; seed/cuttings; fertilizer; chemicals; containers; labels and tags) were the highest operating cost item at $96,978 or $2.77 per square foot for greenhouses producing bedding plants followed by hired labour at $76,048 or $2.17 per square foot. For the combination crops group, the highest cost item was hired labour at $80,647 or $2.46 per square foot followed by material inputs and greenhouse fuel.

Average operating costs for greenhouses producing bedding plants amounted to $251,427 per greenhouse or $7.18 per square foot compared to $229,034 per greenhouse or $6.99 per square foot for the combination crops group of greenhouses. Details on operating costs for both groups are provided in Table 12.

Greenhouse Production Costs and Returns for Bedding Plants and Combination Crops

Average gross revenue for greenhouses producing bedding plants was $320,270 per greenhouse or $9.14 per square foot during the 1988-89 crop year. Average gross revenue for greenhouse operations producing combination crops was $289,328 per greenhouse or $8.83 per square foot.

Average production costs for the bedding plants group were $313,424 per greenhouse or $8.95 per square foot. The costs for the combination crops group amounted to $280,904 per operation or $8.57 per square foot. Average return over operating costs was marginally higher for the bedding plants group when compared with combination crops group, i.e. $1.97 versus $1.84 per square foot. Average return to management was positive for both groups of greenhouses, however, it was slightly higher for the combination crops group at $0.26 per square foot compared to $0.20 per square foot for the bedding plants operations. Details on various operating cost items and total production costs and returns are presented in Table 12.

TABLE 12

COSTS AND RETURNS FOR BEDDING PLANTS AND COMBINATION CROPS

	Bedding Plants	Combination Crops
Number Surveyed	8	17
Greenhouse Area (sq ft)	35,023	32,768
	- - - - - dollars - - - -	
GROSS REVENUE	320,270.00	289,328.25
GROSS REVENUE PER SQ FT	9.14	8.83
Material Inputs	96,978.49	71,376.17
Hired Labour	76,048.50	80,647.00
Greenhouse Fuel	16,807.12	24,371.23
Utilities	5,052.72	6,178.82
Insurance and Registration Fees	4,996.50	3,304.00
Repairs and Maintenance	12,444.87	14,707.70
Freight Leasing and Express	5,721.37	4,906.29
Taxes	2,021.21	1,577.82
Advertising	17,781.37	8,886.41
Accounting and Legal	2,271.37	1,753.12
Marketing Costs	734.25	397.76
Miscellaneous[1]	6,150.87	7,321.41
Interest on Operating Capital	4,618.75	3,606.59
TOTAL OPERATING COSTS	251,427.37	229,034.31
Land, Buildings & Equipment Interest	29,484.11	28,903.45
Depreciation	5,707.75	5,504.63
Operator Labour	26,805.25	17,462.29
TOTAL OTHER COSTS	61,997.11	51,870.37
TOTAL PRODUCTION COSTS	313,424.25	280,904.25
TOTAL PRODUCTION COSTS PER SQ FT	8.95	8.57
Return Over Operating Costs	68,842.50	60,293.94
Return Over Operating Costs per sq ft	1.97	1.84
Return to Management	6,845.46	8,423.57
Return to Management per sq ft	0.20	0.26

1 Includes small tools, shop supplies, soil testing, office supplies, memberships, travel and promotional costs other than advertising.

SECTION IV

GREENHOUSE PRODUCTION COSTS AND RETURNS BY SIZE OF OPERATION

Investment Costs by Size of Greenhouse Operation

The study sample was further divided into three groups according to the size of the operation. Six greenhouse operations were in a group for which the greenhouse area was up to 19,999 square feet; 10 in the 20,000 to 44,999 square foot range; and the remaining six (6) were in the over 45,000 square feet category. Average greenhouse area for the smallest class of operation was 16,565 square feet; for the intermediate size of operation 30,294 square feet; and 93,596 square feet for the large operations.

Average land area associated with a greenhouse operation was 1.68 acres for the up to 19,999 square feet group, 3.25 acres for greenhouses in the 20,000 to 44,999 square feet category, and 7.21 acres for those in the over 45,000 square feet group.

Average building and equipment investment costs were $0.81 per square foot for the smallest class of operations (up to 19,999 square feet), and $0.76 and $1.09 per square foot for the intermediate and large size of operations, respectively. Average investment for the small group amounted to $142,219 per greenhouse ($8.59 per square foot), for the intermediate group, $210,444 per greenhouse ($6.95 per square foot), and for the largest size group, $896,535 per greenhouse ($9.58 per square foot). Average investment costs per operation were $17,762 or $1.07 per square foot for those in the up to 19,999 square feet group; $25,096 or $0.83 per square foot for the group in the 20,000 to 44,999 square feet range; and $106,462 or $1.14 per square foot for

TABLE 13

INVESTMENT AND INVESTMENT COSTS
BY SIZE OF GREENHOUSE OPERATIONS, 1988-89

	Up to 19,999 Sq Ft	20,000 to 45,000 Sq Ft	Over 45,000 Sq ft
Number Surveyed	6	10	6
Land Area (acres)	1.68	3.25	7.21
Land Value ($)	2,861.67	5,533.50	12,254.16
Land Interest ($)	286.17	553.35	1,225.42
Land Interest ($/sq ft)	0.02	0.02	0.01
Building Area (sq ft)	16,565	30,294	93,596
Building Investment ($)	81,591.62	144,550.00	656,151.00
Building Interest ($)	8,159.16	14,455.00	65,615.06
Building Depreciation ($)	1,576.39	1,938.53	11,029.57
Avg Building Interest & Deprec ($/sq ft)	0.59	0.54	0.82
Equipment Investment ($)	52,814.33	50,247.60	202,066.62
Equipment Interest ($)	5,281.43	5,024.76	20,066.66
Equipment Depreciation ($)	1,749.49	1,684.44	4,885.54
Avg Equip Interest & Deprec ($/sq ft)	0.42	0.22	0.27
Automotive Investment ($)	4,951.16	10,112.90	26,063.33
Automotive Interest ($)	495.12	1,011.29	2,606.33
Automotive Depreciation ($)	214.68	428.19	893.42
Avg Auto Interest & Deprec ($/sq ft)	0.04	0.05	0.04
Average Investment ($)	142,218.81	210,443.87	896,535.00
Average Investment ($/sq ft)	8.59	6.95	9.58
Average Investment Costs ($)	17,762.41	25,095.53	106,461.94
Average Investment Costs ($/sq ft)	1.07	0.83	1.14

greenhouses larger than 45,000 square feet. Details on average investment and investment costs by size of operation are presented in Table 13.

Operating Costs by Size of Greenhouse Operation

The average operating costs presented in Table 14 indicate that marketing costs was the largest expense item for the small group of greenhouses. It was followed by greenhouse fuel, interest on operating capital, material inputs, hired labour, and repairs and maintenance. The average operating costs for the intermediate group were the highest for hired labour, followed by material inputs, growing media and seed/cuttings, marketing costs and greenhouse fuel. For the largest group of greenhouses, hired labour was the leading cost item, followed by material inputs (growing media and seed/cuttings), greenhouse fuel and repairs and maintenance. Details on operating costs for the three groups of greenhouse operations by size are presented in Table 14.

In 1988-89, average total operating costs amounted to $62,476 ($3.77 per square foot) for the smallest operations. These costs were $116,346 ($3.84 per square foot) for the intermediate size operations and $617,934 ($6.60 per square foot) for the largest size of greenhouses.

Production Costs and Returns by Size of Greenhouse Operation

The average total production costs per operation were $102,573 for the greenhouses in the up to 19,999 square foot group, $170,160 for those in the 20,000 to 44,999 square foot category, and $765,808 for the greenhouses in the over 45,000 square feet group.

TABLE 14

COMPARISON OF COSTS AND RETURNS BY SIZE OF GREENHOUSE OPERATIONS, 1988-89

	Up To 19,999 Sq Ft	20,00 -45,000 Sq Ft	Over 45,000 Sq Ft
Number Surveyed	6	10	6
Greenhouse Area (sq ft)	16,565	30,294	93,596
	- - - - - - - dollars - - - - - - -		
GROSS REVENUE	97,062.81	164,642.56	804.80
GROSS REVENUE PER SQ FT	5.86	5.43	8.60
Material Inputs	7,835.16	26,919.10	183,222.32
Hired Labour	6,745.00	31,932.30	207,855.81
Greenhouse Fuel	11,206.00	13,817.50	70,083.31
Utilities	4,237.16	4,839.40	15,483.33
Insurance and Registration Fees	1,813.83	2,526.70	7,066.66
Repairs and Maintenance	5,105.16	6,431.10	42,788.33
Freight Leasing and Express	1,205.83	1,088.70	12,216.66
Taxes	676.00	2,552.30	5,125.83
Advertising	100.00	270.40	26,200.00
Accounting and Legal	383.33	1,257.30	4,416.66
Marketing Costs	13,013.61	15,028.00	11,097.83
Miscellaneous[1]	2,062.00	1,528.70	20,131.50
Interest on Operating Capital	8,093.00	8,154.10	12,246.00
TOTAL OPERATING COSTS	62,475.83	116,345.56	617,934.31
Land, Buildings & Equipment Interest	14,221.87	21,044.39	89,653.44
Depreciation	3,540.25	4,051.11	16,808.45
Operator Labour	22,335.00	28,718.90	41,411.83
TOTAL OTHER COSTS	40,097.12	53,814.40	147,873.72
TOTAL PRODUCTION COSTS	102,572.87	170,159.75	765,807.62
TOTAL PRODUCTION COSTS PER SQ FT	6.19	5.62	8.18
Return Over Operating Costs	34,587.00	48,297.00	186,888.62
Return Over Operating Costs per sq ft	2.09	1.59	2.00
Return to Management	(5,150.09)	(5,517.38)	(39,015.16)
Return to Management per sq ft	(0.33)	(0.18)	(0.42)

1 Includes small tools, shop supplies, soil testing, office supplies, memberships, travel and promotional costs other than advertising.

However, average unit production costs per square foot were the lowest for the intermediate size operations at $5.62 per square foot compared with $6.19 per square foot for the smallest operations and $8.18 per square foot for the largest group. Average gross revenue for small operations was $97,063 per greenhouse, or $5.86 per square foot. For operations in the 20,000 to 44,999 square foot class, average gross revenue was $164,643 per greenhouse, or $5.43 per square foot, compared to $804,823 per greenhouse, or $8.60 per square foot in the over 45,000 square feet of area group (Table 14).

Greenhouse operations in the smallest size group (up to 19,999 square feet) showed the highest return over operating costs at $2.09 per square foot, followed by the largest size operations (over 45,000 square feet) and intermediate size groups (20,000 to 44,999 square feet), at $2.00 and $1.59 per square foot, respectively.

Average return to management was negative for the smallest and intermediate size greenhouse operations. It ranged from $0.18 per square foot for the intermediate group to $0.33 per square foot for the smallest size group. Average return to management was positive by $0.42 per square foot for the greenhouses in the largest size operation. Details on average gross revenue, operating costs, other costs and return over operating costs, as well as return to management as determined by the size of operation are given in Table 14.

Comparison of Costs and Returns Between the Study Sample and Individual Greenhouse Operation

The information presented in Table 15 will be of particular significance to study participants as it provides

TABLE 15

COMPARISON OF COSTS AND RETURNS BETWEEN
THE STUDY SAMPLE AND YOUR GREENHOUSE OPERATION

	Study Sample	Your Greenhouse
Number Surveyed	22	_____
Greenhouse Area (sq ft)	44,223	_____
	- - - - - - dollars - - - - - -	
GROSS REVENUE	323,065.12	_____
GROSS REVENUE PER SQ FT	7.31	_____
Material Inputs	54,392.73	_____
Hired Labour	73,209.00	_____
Greenhouse Fuel	28,550.50	_____
Utilities	7,600.09	_____
Insurance and Registration Fees	3,580.45	_____
Repairs and Maintenance	16,027.13	_____
Freight Leasing and Express	4,155.54	_____
Taxes	2,759.66	_____
Advertising	7,294.27	_____
Accounting and Legal	1,886.05	_____
Marketing Costs	13,474.86	_____
Miscellaneous[1]	6,749.68	_____
Interest on Operating Capital	9,260.23	_____
TOTAL OPERATING COSTS	238,940.50	_____
Land, Buildings & Equipment Interest	38,099.91	_____
Depreciation	7,430.81	_____
Operator Labour	30,736.13	_____
TOTAL OTHER COSTS	76,266.81	_____
TOTAL PRODUCTION COSTS	315,206.87	_____
TOTAL PRODUCTION COSTS PER SQ FT	7.13	_____
Return Over Operating Costs	84,124.62	_____
Return Over Operating Costs per sq ft	1.90	_____
Return to Management	7,857.85	_____
Return to Management per sq ft	0.18	_____

1 Includes small tools, shop supplies, soil testing, donations, memberships, travel and promotional expenses other than advertising.

an opportunity for each greenhouse operator to compare his/her results with those of the study sample. Table 15 lists average costs and returns data for the study sample only, and a column has been left blank for the personal use of the study participant. Results of this study were presented at the fourth annual horticultural congress and trade show held in Edmonton during the first week of November, 1989.

SECTION V

COMPARISON BETWEEN 1983-84 AND 1988-89 GREENHOUSE STUDY RESULTS

This section provides a brief comparison of average costs and returns for the two study years for general information purposes only. Although, it is somewhat difficult to compare results of the two study years because of the change in the sample size and crop mix, an attempt was made to show how the major input costs and returns have changed during the last five years.

During the 1983-84 survey of the greenhouse industry, 21 greenhouse operators provided detailed information on their operations. In the 1988-89 survey 22 greenhouse operators were visited to obtain the required information. Some of the growers who participated in the 1983-84 survey were unable to participate in the 1988-89 survey. Therefore, new participants were selected as replacement, thus changing the sample size and cropping mix.

Average area for the 21 greenhouse operations surveyed for the 1983-84 crop year was 34,263 square feet. The greenhouse area for the 22 participants in 1988-89 averaged 44,223 square feet. The latest survey of the greenhouse industry included a few of the largest greenhouse operations in the province, thereby increasing average size for the study sample.

In 1988-89, average gross revenue for the study sample was $323,065 or $7.31 per square foot. Average gross revenue for the study sample in 1983-84 amounted to $248,602 per greenhouse or $7.26 per square foot during the 1983-84 crop year. Conversely, total production costs decreased in

the 1988-89 crop year compared with 1983-84, from $7.46 to $7.13 per square foot.

Details regarding size of the sample, gross revenue, average operating costs, and return over operating costs and return to management for the 1983-84 and 1988-89 crop years are presented in Table 16.

Figures 3 and 4 show the distribution of various cost components for the crop years 1979-80, 1982-83, 1983-84, and 1988-89. Material inputs (seed, cuttings, growing media, fertilizer, chemicals, containers, labels, and tags) increased from 17 percent in 1983-84 to about 20 percent in 1988-89. Labour costs (hired and operator) showed a decrease of 3 percent from 36 percent in 1983-84 to 33 percent in 1988-89.

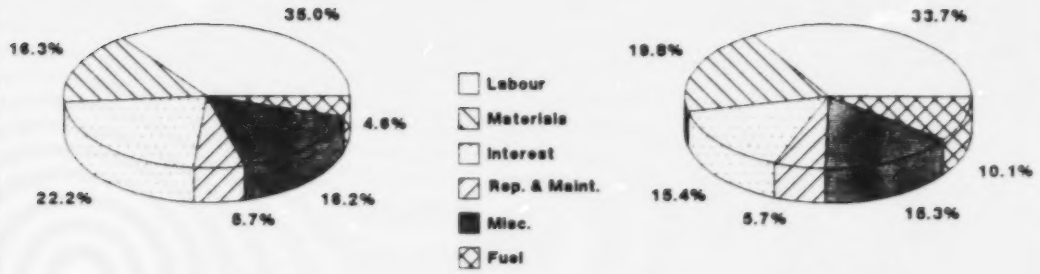
Greenhouse fuel (heating) costs were about 10 percent of overall production costs during 1983-84, and decreased to 9 percent during the 1988-89 crop year. The Primary Producer's Energy Rebate Program did offset a significant part of the greenhouse heating costs and most of the greenhouse operators were quite pleased with the program. Numerous greenhouse owners expressed concerns that if this program is withdrawn, they would not be able to keep their facilities in production during the winter months because of high heating costs.

Interest costs (operating and investment) decreased slightly from 15.6 to 15 percent during the comparison period (1983-84 to 1988-89). Marketing costs (commission fees and other charges) for the greenhouse produce (all crops) almost doubled from 1983-84 to 1988-89.

Miscellaneous costs (small tools, shop supplies, soil testing, office supplies, donations, memberships, travel,

FIGURE 3:

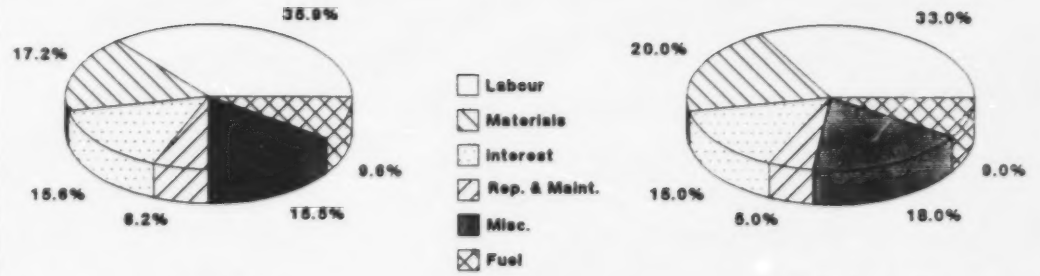
COMPARISON OF GREENHOUSE PRODUCTION COSTS, 1979/80 AND 1982/83 CROP YEARS



1979/80 1982/83

FIGURE 4:

COMPARISON OF GREENHOUSE PRODUCTION COSTS, 1983/84 AND 1988/89 CROP YEARS



1983/84 1988/89

TABLE 16

COMPARISON BETWEEN 1983-84 and 1988-89
GREENHOUSE STUDY RESULTS

	1983-84 Study Sample	1988-89 Study Sample
Number Surveyed	21	22
Greenhouse Area (sq ft)	34,263	44,223
	- - - - -dollars - - - - -	
GROSS REVENUE	248,602.00	323,065.12
GROSS REVENUE PER SQ FT	7.26	7.31
Material Inputs	43,904.33	54,392.73
Hired Labour	55,439.81	73,209.00
Greenhouse Fuel	24,560.91	28,550.50
Utilities	5,029.76	7,600.09
Insurance and Registration Fees	3,098.95	3,580.45
Repairs and Maintenance	15,759.29	16,027.13
Freight Leasing and Express	5,246.09	4,155.54
Taxes	2,529.19	2,759.66
Advertising	1,398.33	7,294.27
Accounting and Legal	1,794.90	1,886.05
Marketing Costs	6,112.14	13,474.86
Miscellaneous[1]	6,811.38	6,749.68
Interest on Operating Capital	11,037.57	9,260.23
TOTAL OPERATING COSTS	182,662.12	238,940.50
Land, Buildings & Equipment Interest	28,918.54	38,099.91
Depreciation	7,751.25	7,430.81
Operator Labour	36,402.71	30,736.13
TOTAL OTHER COSTS	73,072.25	76,266.81
TOTAL PRODUCTION COSTS	255,734.81	315,206.87
TOTAL PRODUCTION COSTS PER SQ FT	7.46	7.13
Return Over Operating Costs	65,939.19	84,124.62
Return Over Operating Costs per sq ft	1.92	1.90
Return to Management	(7,133.20)	7,857.85
Return to Management per sq ft	(0.21)	0.18

1 Includes small tools, shop supplies, soil testing, office supplies, donations, memberships, travel and promotional costs other than advertising.

insurance and registration fees, taxes, freight and leasing, advertising, accounting and legal, and marketing costs for 1988-89 increased to about 18 percent from 17 percent in 1983-84.

SECTION VI

SUMMARY

Summary of Costs and Returns

This section provides a summary of the 1988-89 costs and returns information for the study sample by region, by types of crops grown in the greenhouses, and by the size of greenhouse operations. Twenty-two (22) greenhouse operators were surveyed to obtain data for this study.

When the study sample was divided by regions, there were ten (10) greenhouses (45%) in the north and north-central regions (Group I), and 12 greenhouses (55%) in the south and south-central regions (Group II). Distribution based on the types of crops produced showed eight (8) operations producing mainly bedding plants, flowers (poinsettias, mums and roses), potted plants, foliage plants, and a few selected vegetables. Eleven (11) greenhouses produced Long English cucumbers only and of the remaining 3 operations two produced bedding plants and one produced tomatoes. According to the size of operation distribution, there were six greenhouses in the up to 19,999 square feet category (with an average area of 16,565 square feet), 10 greenhouses were in the range of 20,000 to 44,999 square feet, and the remaining six greenhouses were in the over 45,000 square feet category.

Average production costs and returns for the 1988-89 crop year, summarized according to region, crops produced, and size of greenhouse operations are presented in Table 17. The major production costs were labour (hired, operator, and family), material inputs, and greenhouse fuel. Relative share of these costs of the total production costs for the

TABLE 17

SUMMARY OF GREENHOUSE PRODUCTION COSTS AND RETURNS, 1988-89

	Regions			Crops Produced			Size of Operation		
	Study Sample	Group I[1]	Group II[2]	Bedding Plants	Combination Crops[3]	Cucumbers	up to 19,999 Sq Ft	20,000 to 44,999 Sq Ft	45,000 Sq Ft and Over
Number Surveyed	22	10	12	8	17	16	6	10	6
Average Area (sq ft)	44,223	48,062	41,023	35,023		24,098	16,565	30,294	93,596
	- - - - - - - - - - - - - - - - dollars per square foot - - - - - - - - - - - - - - - -								
GROSS REVENUE	7.31	9.12	5.53	9.14	8.83	4.80	5.86	5.43	8.60
Material Inputs	1.46	2.34	0.58	2.77	2.17	0.37	0.48	0.90	1.96
Hired Labour	1.66	2.07	1.25	2.17	2.46	0.43	0.41	1.05	2.22
Greenhouse Fuel	0.65	0.66	0.63	0.48	0.74	0.53	0.68	0.46	0.75
Other Operating Costs	1.63	1.75	1.56	1.76	1.62	1.77	2.20	1.43	1.67
TOTAL OPERATING COSTS	5.40	6.82	4.02	7.18	5.99	3.10	3.77	3.84	6.60
Land, Building & Equipment Interest & Depreciation	1.03	1.19	0.87	1.00	1.05	0.84	1.07	0.82	1.14
Operator Labour	0.70	0.68	0.71	0.77	0.53	0.96	1.35	0.95	0.44
TOTAL OTHER COSTS	1.73	1.87	1.46	1.77	1.58	1.80	2.42	1.77	1.58
TOTAL PRODUCTION COSTS	7.13	8.69	5.61	8.95	8.57	4.90	6.19	5.62	8.18
Return Over Operating Costs	1.90	2.30	1.51	1.97	1.84	1.70	2.09	1.59	2.00
Return to Management	0.18	0.43	(0.07)	0.20	0.26	(0.10)	(0.33)	(0.18)	0.42

1) Group I is north and north-central regions (3, 4, 5, and 6).
2) Group II is south and south-central regions (1 and 2).
3) Crops include roses, mums, alstermeria, foliage plants, and bedding plants.

study sample were 33 percent, 20.5 percent, and 9 percent, respectively. Other significant cost items were interest costs, repairs and maintenance, and marketing costs.

Average production costs for a greenhouse operation during 1988-89 amounted to $315,207, or $7.13 per square foot, with an estimated gross revenue of $323,065, or $7.31 per square foot. Average production costs were significantly higher for operations in north and north-central Alberta (Group I) when compared to those in south and south-central Alberta (Group II). Total production costs averaged $8.69 per square foot for Group I versus $5.61 per square foot for Group II. Gross revenue per square foot of greenhouse area was $9.12 for Group I compared with $5.53 for Group II. Greenhouses in Group I showed higher returns over operating costs ($2.30 per square foot) than Group II greenhouses ($1.51 per square foot). Average return over operating costs for the study sample was $1.90 per square foot. Average return to management was positive, at $0.43 per square foot for Group I greenhouses, and $0.18 per square foot for the study sample. It was negative by $0.07 per square foot for greenhouses in south and south-central Alberta (Group II).

The greenhouses producing bedding plants and combination crops showed substantially higher costs and net returns compared to greenhouses producing mainly vegetables (cucumbers). Gross revenue for greenhouses producing bedding plants, combination crops and vegetables was $9.14, $8.83, and $5.86 per square foot, respectively. Returns over operating costs for bedding plants and combination crops groups were $1.97 and $1.84 per square foot, compared to $1.70 per square foot for vegetable producers. Average return to management was positive for the bedding plants and combination crops groups at $0.20 and $0.26 per square foot. For the vegetable producing group, average return to

management was negative at $0.10 per square foot. The above results indicate that diversified greenhouse operations, i.e., those producing more than one crop, offered a better return over investment than a single crop operation.

The study sample was further divided by different sizes of operations to develop production costs and returns. Average total production costs ranged from $5.62 per square foot for the intermediate size greenhouse operations to $8.18 per square foot for larger operations. In contrast, gross revenue averaged $8.60 per square foot for larger operations, $5.62 per square foot for the intermediate class, and $6.19 per square foot for smaller size operations. Return over operating costs was highest for the smallest operations ($2.09 per square foot) with an area of up to 19,900 square feet, followed by larger operations ($2.00 per square foot) and the intermediate ones ($1.59 per square foot). Return over operating costs for the study sample was $1.90 per square foot.

In terms of return to management (profit), the small and intermediate groups of greenhouses showed negative returns to management, at $0.33 and $0.18 per square foot, respectively. Estimated profit was $0.42 per square foot for the largest group of greenhouse operations.

Average operating and investment costs for 1988-89 have been summarized according to regions, crops produced, and the size of operations, and are presented in Table 17.

Summary of Findings

Findings of the study are as follows:

i) Greenhouses surveyed for the 1988-89 study year showed considerable structural diversity. Materials covering

the greenhouse frame varied from glass and plastic to fiberglass, acrylic, and polycarbonate. Over the years more plastic has been used in covering the greenhouses.

ii) The study results showed that overall costs and returns were higher for greenhouses in north and north-central Alberta compared to the south and south-central group. The higher costs and returns for Group I operators could be attributed to crop diversification.

iii) The results of the 1988-89 survey of the greenhouse industry revealed that greenhouses producing combination crops, i.e., bedding plants, mums, poinsettias, and roses, showed a much higher gross return than that received by operations only growing vegetables.

iv) Greenhouse operations in north and north-central Alberta showed a profit of $0.43 per square foot compared to a negative return of $0.07 per square foot for greenhouses in south and south-central Alberta.

v) Greenhouse operations with a larger production area and retailing facilities showed a positive return to management of $0.42 per square foot whereas the medium and small groups showed negative returns to management of $0.18 and $0.33 per square foot, respectively.

vi) The cost of energy, a major concern of greenhouse operators, amounted to 12 percent of the total operating costs in the study sample.

The Primary Producers' Energy Rebate Program has been very much appreciated by all producers, as it has helped greenhouse operators to reduce greenhouse

heating costs. Some of the larger operations have expressed concern regarding the maximum limit of the rebate. Several operations suggested that the rebate under this program be tied to the overall use of natural gas and that assistance under this program should be increased and continued.

vii) Farmer's markets in cities and towns are serving a very useful purpose in the marketing of fresh greenhouse produce, especially bedding plants.

ALBERTA GREENHOUSE INDUSTRY ASSISTANCE PROGRAM

In recognizing the concerns of the greenhouse industry, the Alberta Greenhouse Industry Assistance Program has been developed by the provincial government to assist in the "ADOPTION OF NEW TECHNOLOGY", the upgrading of production systems, and further crop diversification.

General Program Eligibility

Commercial greenhouse operators who produce vegetables, floriculture crops, and bedding plants are eligible for assistance under this program. A minimum of 6,000 sq ft of production area is required to be eligible for assistance. This area must be producing greenhouse crops at least six months each year.

Greenhouse area used mainly for retail or display space, greenhouse area in garden centers or nurseries used to hold plant material, and greenhouse area at government related institutions is not eligible.

Eligible participants include individuals, legally constituted partnerships, corporations, and cooperatives. A principal participant can only qualify once to the $40,000 maximum for the life of the program.

Operators of both existing and new greenhouse operations are eligible participants.

Alberta Agriculture reserves the right to verify participant eligibility.

Term of the Program

This is a four year program terminating March 31, 1993. Project applications will not be accepted after June 30, 1992, and projects must be completed by December 31, 1992.

Project Eligibility

The Alberta Greenhouse Industry Assistance Program will provide grants to producers who purchase, develop or manufacture and install technical innovations in new and existing structures. These innovations may be in the form of equipment, structural or operational components.

Initiatives in the following areas are eligible, however, applicants should note that this listing is only a guide to the type of eligible projects.

- environmental and irrigation control computer systems
- supplementary lighting systems
- crop shading and energy curtain systems
- cooling systems
- crop diversification initiatives (changing of a production system to accommodate a new crop)
- specific structural modifications to improve production efficiencies (mechanical screening for pest exclusion, installation of energy efficient coverings)

Consultation and/or design fees to maximum of $2,000 or 10 percent of the approved cost of the project, whichever is less, is also an eligible expense.

This program is designed to facilitate new technology adoption, therefore the following types of project expenditures are not eligible.

- project costs that do not specifically relate to the introduction of new technology or crop diversification
- material cost for structure replacement or the construction of new greenhouses, except the specific new technology items eligible under the program
- general heating system upgrading (such as heating pipe insulation)
- insulation of walls, ends and foundations when this is the only planned improvement

Projects should have an economic life of at least five years, and should show a reasonable cost/benefit ratio to receive approval. Labour costs of the operator and permanent employees are not eligible expenses.

Projects commenced or completed prior to approval by Alberta Agriculture are not eligible.

Project Approval

An Alberta Agriculture Committee will review all grant applications. Each application will be reviewed and assessed independently, and all information received will remain confidential. The ability of the applicant to complete the proposed project is part of the assessment process. Applicants may be required to provide detailed financial or other data to support their application.

Applicants should allow four to six weeks for project approval. Notification will be in writing and approval will be subject to the acceptance of conditions specified.

Follow-up Evaluation

Participants will be asked to evaluate the effectiveness of their project by completing an evaluation form one year following the completion of the project. This evaluation must ensure that adequate data is recorded. The data should include cost effectiveness of projects, data on increased productivity, and reduced heating costs. Evaluation forms will be provided by the program administrators.

Type and Level of Assistance Payment

Assistance in the form of a grant will be paid upon completion of the project. A separate grant approval form is required. The grant amount will be determined by calculating one-half of all eligible costs of approved projects supported by invoices to a maximum of $1.00/sq ft or an overall maximum of $40,000 per operation over the life of the program. All projects are subject to inspection by Alberta Agriculture prior to grant payment.

PAYMENT IS SUBJECT TO AVAILABILITY OF FUNDS, which are allocated yearly. Total funding for the program will not exceed $2.4 million.

All assistance offers are subject to provincial audit as to the expenditure of awarded funds.

Submitting Applications

Greenhouse producers may request grant application forms and project plan forms from the Alberta Special Crops and Horticultural Research Center, or the Alberta Tree Nursery and Horticulture Center.

1 Alberta Special Crops
and Horticultural
Research Center,
Bag Service 200
Brooks, Alberta T0J 0J0
Phone: 362-3391

2 Alberta Tree Nursery and
Horticulture Center
R.R. #6
Edmonton, Alberta T5B 4K3
Phone: 472-6043

The principal applicant is required to complete the grant application and project plan form. The project plan requires details on project construction, equipment availability, business plan and other pertinent information. Greenhouse specialists are available for consultation prior to application submission. Call 362-3391 or 472-6043.

Applications and project plans should be mailed to:

Alberta Greenhouse Industry
Assistance Program
Alberta Special Crops
and Horticultural Research Center
Bag Service 200
Brooks, Alberta
T0J 0J0